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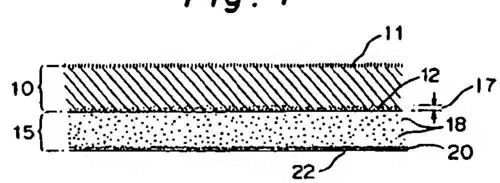
(54) **SKIN MATERIAL BACK-COATED WITH THIN-FILM LATEX FOAM AND INTEGRATED FOAMED PRODUCT UTILIZING THE SKIN MATERIAL.**

(57) A skin material for an integrated foamed product, formed in such a manner that polymer latex such as rubber or synthetic resin is applied to the inner surface (12) of breathable cloth (10), expanded and cured, and a latex foam thin layer (15) provide in the interior thereof with relatively fine mechanical open cells (18), in a portion close to the surface thereof with a denser open cell layer (20) and on the surface thereof with a breathable skin (22) is bonded with the breathable cloth (10) through a strong bonding region (17). The breathable skin (22), while having pores (21), has a substantially smooth outer surface which can smoothly introduce a stock solution of main body foams (25) directly poured onto the skin and can satisfactorily prevent the stock solution (25) from substantially intruding into the latex foam thin layer (15).

Fig. 1



TECHNICAL FIELD

This invention relates to a cover fabric with back-coated thin layer of latex foam, and to a foamed article integrally molded with the said fabric. More particularly, the invention relates to a composite cover material comprising a permeable fabric having a thin permeable layer of foamed latex adhered to its back or inner surface, and to a foamed article such as vehicle seats, seat cushions, headrests, armrests, sun visors and the like, all produced by utilizing the composite fabric of the invention in the integral molding technique.

BACKGROUND ART

It has long been well known to produce a soft foam article having a cover integrally adhered thereto by providing a permeable cover fabric in the shape of desired final article and pouring into the shaped cover fabric a soft polyurethane stock material to form a body foam which is integrally adhered with the cover fabric. However, if the liquid stock material is injected directly onto the inside surface of the permeable fabric, the material easily permeates into or even through the texture of the fabric so as to form disadvantageously partially stiffened areas uncomfortable in touch and called, e.g., hard spots or hard layers in the fabric. To avoid these disadvantages, it is proposed in the art to provide a buffer layer to prevent the stock solution from penetrating the cover fabric.

According to this proposal, it is alleged that a thin urethane foam (called "slab foam" or "slab urethane") is adhered as a buffer layer to the inside surface of the cover fabric. Polyurethane stock solution may be directly poured onto this urethane foam and penetrates only slightly into the urethane foam thereby to produce a thin "superficial" layer which provides sufficient bonding strength between polyurethane body foam and the cover fabric to which the slab urethane is adhered.

However, many disadvantanges are found in that creamy polyurethane stock poured directly onto the slab urethane buffer layer tends to easily penetrate relatively large cells of the buffer layer or pass through the buffer layer to reach the cover fabric to adversely for thereat hard spots, or the poured stock material permeates the buffer layer over the wide range thereof to produce undesirable thick stiffened or impregnated layers.

On the other hand, for the purpose of avoiding penetration or impregnation of the body foam into the cover fabric, a technique to apply an airtight film on the inside surface of the cover fabric are proposed in various United States Patents. For example, U.S.Patent No. 4,247,347 to Lischer et al., January 27, 1981, No.4,247,348 to Lischer, January 27, 1981, No. 4, 264,386 to Sears, Jr. et al., April 28, 1981, and No. 4,287,143 to Sears, Jr. et al., September 1, 1981 disclose applying of airtight films, preferably vinyl polychloride film, to the back surface of the cover fabric. Such airtight or impermeable films, however, deprives the finished foamed article of the permeability, which leads to uncomfortable feeling such as moist or stickly touch on the surface of the article.

If the use of thin urethane foam (called slab urethane) above-mentioned and the use of impermeable films taught by various U. S. Patents may be combined together, no particular effects can be expected to attain comfortable feelings on the surface of the article resulting from the permeability of the cover fabric. To attain the desired comfortability, there must be an intermediate layer which is permeable in nature between the cover fabric and the body foam and also contributes to prevention of substantial penetration or impregnation of the body foam into the intermediate layer itself.

Furthermore, use of the slab urethane as buffer layer in the prior art is not found to be favorable technique in that it involves time-consuming manufacturing processes such as producing first a large mass of foamed urethane and then slicing the mass into a plurality of slab urethane which are difficult to be handled and require large space for keeping them before using the same, and that sliced slab urethane ought to be applied to the cover fabric by using the flame welding technique which inevitably produces a large amount of poisonous gases imparting adverse influences to the workmen in the factory and also the environment thereof. In addition, if, on the basis of teachings of the aforementioned U. S. Patents, an improved method be divised wherein non-airtight, porous films can be applied to the inner surface of the aforementioned slab urethane buffer of the prior art to produce a favorably permeable foamed article such as seat cushions, such a method cannot solve essentially problems so long as it involves cumbersome and expensive processes for preparing slab urethane foams and applying the same onto the back surface of the fabric and it releases a large amount of poisonous gases during bonding the film onto the buffer layer and the buffer layer onto the fabric by means of flame welding technique.

DISCLOSURE OF INVENTION

Accordingly, it is an object of the present invenion to provide a novel cover material for use in integrally molded foam articles which is able to be manufactured through simple procedures without producing poisonous gases and other environmental pollutions and which has a desirable permeability as well as a good ability to prevent penetration or impregnation of the body foam otherwise causing formation of hard spots or other inconveniences in the final article.

It is another object of the invention to provide a method for manufacturing the above-mentioned cover material in a practical manner.

It is yet another object of the invention to provide an integrally foamed article itself prepared by using the above-mentioned novel cover material.

These and other objects of the present invention can be accomplished by providing a novel cover material comprising a permeable fabric and a thin layer of latex foam integrally applied to the back surface of the fabric, the latex foam being prepared by applying one or more latices of high molecular mateials including rubbers and synthetic resins to the permeable fabric as a back-coating and permitting the same to foam and cure thereby to cause numerous fine open cells to be formed in the internal part of latex foam layer and also finer or denser open cells to be formed in the region adjacent to the outer surface of the latex foam layer. On the outer surface of latex foam is also formed a superficial skin which is permeable or breathable in nature and yet acts as a barrier agaist a stock material for making a body foam of an article.

The thickness of latex foam layer can be controlled by varying the amount of a latex material applied to the fabric and preferably latex material may be caused to foam and cure such that the final layer of latex foam becomes usually from 0.1 to 3.0 mm (millimeters) thick. Open cells formed in the thin latex foam layer are mechanical open cells which can be relatively easily controlled in the number of cells by adjustably conducting mechanical stirring of latex materail before applying it to the fabric. Adjusting is possible by thorough stirring to increase the number of cells and to reduce the density of thin latex foam layer so as to increase permeability of the layer. In this respect, it is not easy to controll directly the sizes of open cells, but it is possible to increase the thickness of finer or denser cell layer. In general, denser cells have sizes ranging from 2 μ (microns) to 10 μ, whereas internal open cells range from 10 μ to 30 μ. The number of cells can be varried on the average preferably from 20,000 cells per cm^2 to 70,000 cells per cm^2. These adjusting can be easily carried out in the place where the cover materials are manufactured utilizing latex foam layers of the invention in contrast to the prior art slab urethane foam which are supplied as finished products from another place. Further, the latex foam layer employed in the present invention has a distinct advantage that the sizes of open cells in latex foam layer are one fifth to one tenth as small as those of prior art slab urethane, and even from one tenth to one eightyth in the superficial skin.

As a fabric composing the cover material of the invention, knitted, woven or non-woven fabrics of natural fibers such as cotton and woolen yarns, a variety of synthetic fibers and mixtures thereof may be used. The fabric should be permeable, hygroscopic and of comfortable touch. Prior to coated with latex material, the fabric should be cleaned to remove any wrinkles, creases, dusts, etc., and conditioned for flatness.

Latices used in the present invention include rubber latices such as various natural and synthetic rubbers, e.g., styrene butadiene rubber, acrylonitrile butadiene rubber, natural rubber, silicone rubber, methylene butadiene rubber and the like, modified forms and copolymers thereof; and resinous latices such as various synthetic resins, e.g., acrylic, urethane, vinyl chloride, vinyl acetate, polyvinyl alcohol, polystyrene, polyethylene, and modified forms, alloy and copolymers thereof.

Appropriate material selected from the above-mentioned candidate latices is first subjected to mechanical stirring operaton while held at an adequate temperature in the range of about 20 - 40 °C so as to be ready for producing mechanical cells when applied to the fabric. The lesser stirring is done, the lesser number of cells will be produced with the lesser permeability. It ts important in the present invention that sufficient stirring is done to cause air to be taken sufficiently into the latex mass so as to provide the latex foam having lower density and, therefore, the greater number of cells. Stirring should be done at the temperature in the range above noted for the period of from 3 to 5 minutes depending upon the particular latex material selected.

Subsquently to stirring, latex material is applied to the back surface of the particular fabric at a temperature also in the range of about 20 - 40 °C by means of knife-coating or roll-coating technique. If latex is applied at too low temperatures, large air bubbles may be caught up in the latex mass and uniform thickness of latex coating will hardly be attained. On the other hand, too high temperatures are also inadequate in that air bubbles are caused to easily escape out of latex mass and highly bulky coating is made uneasy to be attained.

Latex material, upon applied in a predetermined thickness, is subjected to a preliminary drying step and a curing step. Whereas these steps may be conducted in a varied way dependent upon desired thickness of coating and density sought for latex foam, it is preferable in the standard procedure that preliminary drying be done at a temperature ranging from 80 to 120 °C for the period of 3 - 5 minutes and subsequent curing be at a temperature of from 150 - 170 °C for the period of 2-3 minutes. If preliminary drying is done at too high temperatures and for too short period, resultant latex foam will be found unsatisfactory because of a thick skin, a thin denser layer, and large internal open cells as well as large holes in the skin, which all together lead to undesired impregnation of the body foam into the latex foam. In contrast, if latex material upon applied to the fabric is allowed to stand for too long period, for instance, overnight, latex foam with a thin skin, denser or smaller cells in the major part, few large cells and minute holes in the skin will result so that impregnation of the body foam into the latex is well prevented, at the sacrifice of permeability, however.

To obtain an adequate permeability and as many denser cells as possible in the latex foam, it is preferable to conduct a crushing operation subsequently to the preliminary drying step. That is, latex material is sufficiently stirred so as to produce a latex foam of as low density as possible (the greater number of cells), applied to the back surface of the fabric and dried preliminarily, and then, the entire fabric is subjected to a crushing operation in which larger cells of the latex foam are crushed and conveniently reduced to smaller cells suitable to restrain permeability of the latex foam. Depending upon the extent of crushing operation carried out, permeability of the latex foam can be controlled to a certain extent. Thus, crushing is an advantageous means to obtain a desirable latex foam of the invention having light weight, many denser cells, good permeability and ability to prevent impregnation by the body foam. Usually, crushing is carried out either by machinery or by mannual labor, but preferably as a simplest way the fabric with the latex foam applied thereto may be passed between a pair of crushing rolls which are freely adjustable in regard to the distance therebetween.

The composite cover material of the present invention thus prepared comprises the thin latex foam layer having on its outer surface a substantially flat and smooth skin and in its internal part mechanical open cells susceptible to be controlled as to its formation. Thus, the cover material of the invention can retain as good permeability as desired and a superior ability to prevent deep penetration or impregnation thereinto by the body foam so that no noticeably stiffend impregnated layer is formed in the backing unlike the prior art cover fabric with urethane backing. Moreover, the latex foam layer of the invention provide strong mechanial bonding to the body foam due to its denser cell layer and skin with minute holes. Therefore, the cover material of the present invention is most adequate to be used for making an integrally molded article having comfortable and soft touch and high degree of permeability. Among various integrally foamed articles for which the cover material of the invention is applicable, vehicle seats, seat cushions, headrests and armrests are practically producible, and in paricular thin and elongate products such as sun visors can also advantagesourly be fabricated with high quality and at low cost by the cover material of the invention.

The cover material of the invetnion can be manufactured in a simpler, safer and more inexpensive process than the prior art cover material with urethane backing. Latices used in the invention are water soluble sol (coloidal solutions) which, upon applied to the fabric, are securedly fixed to the fabric fibers such that latex materials upon cured embrace individual fibers of the fabric to make mechanical bondings between latex foam and fibers, so that bonding strength between the fabric and the latex foam backing is hardly influenced by different type, composition, texture and so on of the fabrics employed. On the contrary, the prior art cover materials with slab urethane are very likely to have varied bonding strengths wigh different fabric surfaces due to uneven surface conditons to which slab urethane is to be adhered or bonded. By the present invention, many kinds of fabrics can substantially unlimitedly be employed for manufacturing the composite cover material so that great degree of flexibility in designing the integrally foamed article is ensured. Due to more uniform bonding strength than that of adhesives or welding, the invention assures to produce an integrally foamed article having stable nature and high quality.

Further, the method for manufacturing the cover material of the invention is recommendable from the view point of environmental hygienics because the latices employed in the invention are water soluble sol solution and they do not produce in any sense poisonous and pollutional gases which would be produced by flame welding process of the prior art slab urethane backing.

Additionally, in the process for making the integrally molded article, foamable mixture is generally over-packed in greater amounts than theoretically calculated into the shaped cover material for the purpose of obtaining a desired shape as prescribed by the designer. In this respect, the prior art slab urethane back-coated fabric cannot get rid of defect that the foamable mixture penetrates more deeply into the slab urethane foam under higher pressure of over-packing. In contrast to this, the cover material of the invention having latex foam backing can allow over-packing of about 5 -8 % as high as the calculated level with only slight penetration unnoticeably occurred due to the superficial skin and denser cells of the latex foam, and

thus permit both the good shaping and the attainment of comfortable feeling of the final article to coexistent.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a partial schematic secition of a cover material according to the invention showing integrally bonding fabric and back-coated latex foam and a surface skin of the latex foam.

Figure 2 represents a microscopically enlarged sectional view of a cover material according to the invention and a body foam integrally adhered thereto wherein a portion of latex foam adhering to some fibers of the fabric, a thin layer of latex foam having internal mechnical open cells and a surface skin, and a body foam strongly bonded to the surface skin can be clearly seen.

Figure 3 illustrates one of manufacturing steps according to the invention wherein a headrest as an exemplary foamed article of the invention is being manufactured by injecting a high reaction type of foaming stock material into a cover material of the invention preliminarily shaped within a mold.

Figure 4 shows two elongate foamed articles, utilizing a cover material with back-coated latex foam of the invenion for (A) and a conventional cover material with "slab urethane" bonded thereto for (B), respectively, for comparison of the distances L_1 and L_2 reached by foaming materials poured into the respective cover materials.

Figure 5 is a diagram showing differences between the invention and the conventional art.

Figure 6 represents comparative views of a thin layer of latex foam of the invention (A) and a conventional slab urethane (B) shown schematically in microscopically enlarged scale.

Figure 7 illustrates another example of an integrally foamed article using the cover material of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to the drawings, in particular Figure 1, a cover material according to the invention is illustrated as comprising a permeable or breathable fabric 10 and a thin layer of latex foam 15 back-coated to the inner surface of fabric 10. As previously mentioned, fabric 10 may be selected from knitted, woven and non-woven fabrics made of natural fibers such as cotton and wool, a variety of synthetic fibers and mixtures thereof, which are well permeable, hygroscopic and of comfortable touch. Preferably, knitted fabrics of polyester fibers are usually employed. Fabric 10 has an outer surface 11 and an inner surface 12 with which a thin latex foam layer 15 according to the invention is interconnected through a bonding zone 17 as more fully discussed hereinafter.

Thin latex foam layer 15, which is formed by directly applying an appropriate foaming material selected from a wide variety of candidate materials and permitting the material to foam and cure in-situ. Latex foam layer 15 has in its internal part innumerable mechanical open cells 18 which are relatively large in size and communicate with each other. On the opposite side to the fabric 10, latex foam layer 15 has a layer 20 of relatively denser open cells which are formed concurrently with the larger open cells 18 and an extremely thin surface skin 22 on the outside surface of denser cell layer 20.

As seen in Figure 1, surface skin 22 has numerous minute holes 21 which render the skin 22 permeable or breathable and yet present a substantially flat and smooth barrier surface to permit liquid stock poured thereon for forming a body foam 25 to be guided therealong smoothly and extensively without substantial penetration into minute holes 21. In this respect, latex foam layer 15 of the invention differs essentially from the conventional slab urethane foam as fully explained later in connection with two examples shown in Figure 6 (A) and (B). It is preferable that latex foam layer 15 of the invention has a thickness ranging from 0.1 to 3.0 mm (millimeters), and most preferably from 0.8 to 2.0 mm.

Figure 2 shows schematically and in microscopically enlarged scale cross sectional view of a formed article made by directly pouring stock solution for the body foam 25, for example, high reaction type polyurethane mixtures onto the inside surface, i.e., surface skin 25, of the cover material. In Figure 2, the fabric 10 is shown only for its inner portion adjacent to the inner surface 12 shown in Figure 1, with some woofs 13 and warps 14 appearing in a fragmental fashion. Latex foam layer 15 in the region most adjecent to fabric 10 more likely than not embraces fabric fibers, warps 14 in this instance, to make mechanical bondings 16 with fibers, which constitute as a whole strong bonding zone 17 to ensure very strong connection of fabric 10 and latex foam layer 15. Unlike the flame welding used to bond together the conventional slab urethane and the fabric, no poisonous gases occur during the bonding process of the latex foam to the fabric according to the invention, which can be carried out safely and silently with relatively simple and easy operations without any fear of environmental pollution.

Thin latex foam layer 15, upon cured and dried, has numerous mechanical open cells 18, as clearly shown in Figure 2, which communicate with each other and from end to end to ensure good permeability through the entire mass of latex foam 15. Adjacent to the undersurface of latex foam 15, relatively denser layer of smaller open cells 20 are advantageously produced during its foaming process, and on the outermost part of denser layer 20 is formed the superficial skin 22 which is also permeable by virtue of minute holes 21. The superficial skin 22 is, irrespective of minute holes 21, substantially flat and smooth barrier surface against penetration of foaming stock for body foam 25 poured directly thereon. Thus,according to the invention, foamable mixtures such as high reaction type polyurethane, even where impinging directly upon superficial skin 22, do not penetrate susbtantially the latex foam 15 nor form any noticeable stiffened layer in the latex foam in clear distinction from the conventional slab urethane foam which would produce rather thick hardened layer within itself by direct contacting with injected liquid foamable material. In the present invention, foamable mixtures contacting with super ficial skin 22 in yet cured state can not easily enter the latex foam 15 because minute holes 21 resist their attempts to pass therethrough in substantial volumes, and in a little while foamable mixtures undergo rapidly foaming and curing reactions within minute holes 21 or at most only slightly over the minute holes where the mixture become completely cured composition and stop their progress toward the inside of latex foam 15, so that so called stiffend layer, if formed, is as very thin as the denser cell layer 20 and is not substantially noticeably sensed from the outside of the fabric. Though very thin, however, this stiffend layer formed within denser cell layer 20 well serves necessary interconnection between the body foam 25 and latex foam 15 and, hence, denser cell layer 20 with its superficial skin 22 functions to be barrier against substantial penetration of the body foam into the latex foam. Thus, the composite cover material of the invention has distinct features which would never be expected heretofore in that it has the mechanical bonding zone 17 serving to form strong connection of the fabric 10 and the latex foam 15 and also has on the opposite side permeable skin 22 and a controllably formed denser layer 20 serving together restriction of substantial penetration of the body foam and yet formation of strong interconnection with the body foam. Moreover, the superficial skin 22, though having minute holes 21, presents substantially flat surface to smoothly and slidingly guide the foamable mixture for the body foam 25 over as extensive and wide areas as possible.

An exemplary foamed article which can be advantageously prepared by using the composite cover material is illustrated in Figure 3 in which a headrest 30 to be mounted on the top of a seat back (see Figure 7, reference numeral 61) is being molded in a mold M. A composite cover material 31 according to the invention has been pre-contoured into any desired configuration of the headrest with fabric 10 facing outward and latex foam facing inward to form a hollow box-like shape through sewing or welder treatment. Permeable skin 22 of latex foam 15 covers the entire inner surface of the headrest. The hollow box-like headrest has a fixture 33 attached to its bottom, through which an injection nozzle 32 is inserted into the inside of the hollow headrest, and then assembled nozzle and headrest cover 30 is set in an appropriate mold M shown in phantom lines in Figure 3. An outer end of the nozzle 32 may be connected to a source (not shown) for supplying foamable mixtures for the body foam. A headrest core member 35 which is of metal or plastic is detachably supported on the inner end of the nozzle 32. In operation, a foamable liquid mixture 36 is injected through the nozzle 32 on the core 35 and rapidly expands and foams in creamy state while it flows to a top side (right side in Figure 3) of the headrest where it impinges against the skin 22.

In the prior art system utilizing the cover material with slab urethane back-coating, creamy foaming materials which impinge upon the slab urethane in yet cured state would penetrate easily and relatively deeply into the slab urethane to form disadvantageously stiffend zone therein, so that a relief measure such as a small block 38 shown in phantom lines in Figure 3 should be disposed on the free end of the core 35 to disperse creamy foaming material therearound. In contrast, latex foam layer 15 with denser layer 20 and skin 22, though permeable through very minute holes 21, does not permit substantial penetration tereinto of the foaming mixture which, impinging upon the skin 22 in the top side of the headrest, will soon undergo and terminate its curing reaction and only minute portions of foaming mixture can enter the minute holes 21 as previously described in connection with Figure 2. Another portions of foaming mixture injected on the core 35 and dispersed in all directions in creamy state also reach another parts of the skin 22 of the entire inner surface of the headrest in the same fashion as immediately above-mentioned and substantially terminate their curing reactions thereat with only minute portions of the mixture penetrating the skin or at most the denser layer. Thus, by utilizing the composite cover material of the invention, it is possible to pour or inject foamable mixture directly into the shaped cover material to obtain an foamed article of high quality without fear of adverse penetration or impregnation of foaming mixtures into the fabric.

The cover material 10 of the invention has, as mentioned before, an advantage that it can slidingly and smoothly guide foaming mixture injected thereon extensively over the wide and long range. This advantage can be depended upon particularly where relatively thin and elongate foamed articles are to be manufac-

tured. Figure 4 illustrates this advantage in comparative tests.

Figure 4 (A) shows a tube 40 made of the cover material of the present invention comprising permeable fabric 10 and latex foam 15 back-coated thereto as already discussed in connection with Figures 1 and 2. Tube 40 is prepared by sewing a rectangular cover material into a tubular shape having inner diameter of about 40 mm and a length of about 500 mm. Through an opening 41 at one end of the tube 40 was inserted an spout of a mixing head (not shown) as indicated in broken lines and a high reaction type urethane mixture HR was injected through the spout. (Formulations of the mixture HR is seen in TABLE 1 below.) Figure 4(B) shows a similar tube 50, but made of the prior art cover material with back-coated slab urethane foam U, and through an opening 51 thereof is inserted the same spout through which the same mixture HR as in (A) is injected. Injection for both tubes was made almost instantaneously (in a fraction of one second) to supply a predetermined amount of mixtures (see TABLE 1 below). Foaming mixtures HR thus injected flow along the inner surface (15 or U) of the tube toward the outer end (42 or 52) while expanding and foaming and stop their motion upon cured. The distance reached by the respective leading end of the foamed mixture HR is indicated by L_1 (the present invention) and L_2 (prior art), respectively. Apparently, the tube made of the cover material with latex foam backing 15 of the invention permits the injected mixture to attain a longer distance than the tube employing the prior art slab urethane backing U due to the difference in penetration or impregnation of foaming mixtures into the respective backings.

Five (5) test results obtained in a similar manner to Figure 4 (A) and (B) are depicted in TABLE 1 below.

TABLE 1

RUNS	Tube ID(mm)	Inject Time(sec)	Inject Amount (g)	Distance attained (mm)	Volume of Foam theory (liter)	Found (liter)	% Distane attained	Apparent Density (g/cm³)	Hardness Ascar C-type near nozzle	middle point	near end	Tube structure
Run 1	41	0.24	35	355	.66	.469	71	.0746	21-24	15-18	12-14	end closed
Run 2	43	0.26	39	370	.726	.537	74	.0726	11-15	12-15	12-14	〃
Run 3	40	0.25	39	363	.63	.457	73	.0853	17-18	14-16	11-14	end opened
Run 4	44	0.3	48	402	.76	.611	80	.0786	10-14	8-11	8-12	〃
Run 5	43	0.29	43	356	.726	.517	71	.0832	15-18	12-14	10-14	〃

N.B. (1) Runs 1, 3 and 5 were conducted on the cover material with slab urethane backing of the prior art. Runs 2 and 4 were on the cover material with latex foam backing of the invention. All cover material was sewn up into tube of 48-49mm outer diameter. High reaction urethane mixture for body foam was injected into each tube under no pressure charged.

(2) Each "Inject Amount" (injected amount) was calculated so that urethane to be injected could reach 500 mm point from nozzle end on the assumption that no impregnation of urethane into backing would occur.

As noted from TABLE 1, Run 2 (tube made of the cover material of the invention with one end closed) has attained the lowest density (apparent density). With different tube structure (both ends closed) in Runs 3 to 5, cover material of the invention (Run 4) again exhibits lower density than the prior art .

Also it is noted from TABLE 1 that the cover material using latex foam backing of the invention has achieved better results than the prior art in many respects, such as actual volumes attained by the body

foam ("Volume of Foam" found), distance actually attained by the body foam, and % Distance attained (ratio of distance actually attained by the body foam to theoretical distance 500 mm).

Visual inspection of internal structures of tested tubes upon cross cut revealed that the prior art slab urethane foam had relatively thick stiffened impregnated layer formed by high reaction urethane mixture penetrated into the slab foam backing, and particularly in the region adjacent to the injection nozzle greater and thicker stiffened layer was formed in comparison to lesser stiffened layer adjacent to the other end.

In clear distinction therefrom, with the latex foam layer of the invention, only very thin impregnated layer was formed and hardly sensed by fingers pressing the foamed tube from the outside throughout the entire length thereof.

As to hardness(Ascar C-type), the prior art slab urethane foam exhibits high values near the injection spout and rapidly lowered values near the other end as seen from Runs 1,3 and 5. This is due to differences in impregnation along the length of the tube. Contrastedly, the latex foam layer of the invention shows substantially uniform hardness throughout the entire length from the injection point to the other end as seen from Run 2 which means no substantial difference in impregnation.

Figure 5 depicts test results from Run 3 (the prior art) and Run 4 (the invention) above-listed, the ordinate representing hardness (Ascar C-type) and the abscissa indicating distance actually attained by the body foam. In Figure 5, solid line U represents the performance with the slab urethane backing, and broken line L indicates that of the latex foam backing. With the latex foam backing L, the body foam could reach 402 mm point from the injection point, whereas with slab urethane backing U the body foam stopped at 363 mm point. With the urethane backing U, the body foam shows Ascar C-type hardness of more than 17 near the injection point and 13 at terminal point (363 mm), thus linearly decreasing hardness, whereas with the latex backing L hardness is noted to be substantially uniform, i.e., about 12 near the injection point and about 10 at middle and terminal points. Further, the prior art cover material with urethane backing is noted to have generally high level of hardness (more than 14), whereas the cover material of the invention is noted to allow generally lower level of hardness (lower than 14). This is due to difference in impregnation into the backing by the body foam, with larger impregnation in the prior art and smaller impregation in the present invention, from which it is realized that, particularly for the foamed article of small diameter or thin thickness the cover material of the invention has superior ability to permit the body foam to extend longer distance and to suppress formation of impregnated stiffened layer.

Figure 6 depicts also the difference of ability of these backings, (A) being a diagrammatically enlarged view showing the surface of the latex foam of the invention, (B) being a diagrammatically enlarged view in the same scale of the surface of the slab urethane backing. An outer surface 22 of the latex foam is shown with relatively coarse hatching for clarity purpose and this is the superficial skin previously mentioned in which denser cells 21 are formed numerously. Cells 21 are extremely small, i.e., 2μ (microns) or at most 10μ in diameter. Inside the skin 22, denser cells like cells 21 at surface are cumulatively formed in the latex foam, and further inside a little larger open cells 18 are formed with 10 - 30μ diameter while communicating with each other. These cells 18 are shown by denser hatching and mainly by broken lines. In Figure 6 (A), a little larger open cells 18 are illustrated as appearing immediately behind minor cells 21, but in fact, as a thin denser cell layer 20 exists between the skin 22 and the zone including open cells 18 as already explained and illustrated in Figure 2, open cells 18 cannot be seen directly from the skin 22.

In the prior art slab urethane backing, as shown in Figure 6 (B), open cells C are formed on the surface with 5 - 10 times as large as those of the latex foam and yet membranes M between cells are conversely thinned. Of course, no skin is formed on the surface.

As already understood, with the slab urethane backing of the prior art, the stock solution for the body foam is very susceptible to enter the cells C as there is no or little "outer surface" by which the stock solution is blocked or guided slidingly. Contrastedly, the latex foam backing of the invention is advantageously provided with relatively thick membranes or walls between minor cells 21 in the skin 22 , and cells 21 are extremely small in diameter so that creany or liquid foamable mixture, if injected directly upon the skin 22, can beneficially be blocked by the skin and prevented substantially from immediately entering the cells 21 thereby to stay on the skin a little while, during which the liquid mixture, as being high reaction type, proceeds very rapidly into creamy or foaming and expanding state such that it is unlikely to enter the minute cells 21. The foaming mixtue, thus resisted by the minute cells, is made to run and spread over the skin surface 22 to extend into furthest points and attain longest distance heretofore unexpected.

In this manner, impregnated stiffened layers in the latex foam of the invention can hardly be formed by the foaming mixtures, and highly comfortable, soft and resilient foamed article having no hard spots over the entire surface can be assuredly produced according to the novel cover material of the invention.

Specific formulations of latices which can be used for the composite cover material of the invention are exemplified below.

EXAMPLE 1 Urethane latex	
Ingredients	parts by weight
DICFOAM F-505 EL* (acrilonitrile butadiene copolymer modified urethane)	100
F-1 * (ammonium stearate)(foamin agent)	10
CR-5L* (crossliking agent)	3
VONDIC NBA-1* (foam regulator)	1
CMC* (4% solution)(thikener)	3
VONCOAT 3750* (thikener)	1
CATALYST PA-20* (catalyst)	1
foaming magnification 3 times	

* trade name of Dainippon Ink Chemical Indursty Co., Ltd.

EXAMPLE 2 Acrylic latex	
Ingredients	parts by weight
VONCOAT 350*	100
F-1 * (ammonium stearate)(foaming agent)	10
VONDIC NBA-1* (foam regulator)	1
CMC* (4% solution)(thickenenr)	3
VONCOAT 3750* (thickener)	3
25% ammonium solution (stabilizer)	0.3
CATALYST PA-20* (catalyst)	1
foaming magnification 3 times	

* trade name of Dainippon Ink Chemical Indursty Co., Ltd.

EXAMPLE 3 Methylene butadiene latex	
Ingredients	parts by weight
DICFOAM F-601* (methylene butadiene copolymer)	100
F-1 * (ammonium stearate)(foaming agent)	10
CR-5L*(crossliking agent)	2
VONDIC NBA-1* (foam regulator)	1
VONCOAT 3750* (thickener)	1
CATALYST PA-20* (catalyst)	1
foaming magnification 3 times	

* trade name of Dainippon Ink Chemical Indursty Co., Ltd.

The cover material of the invention is adapted to be used for making various soft and resilient molded articles having good shapability and comfortability, including integrally foamed articles such as headrest shown already in Figure 4. Other exemplary articles are illustrated in Figure 7, that is, in addition to headrest 30, seat portion 60, seat back 61 and armrest 62 are typical products made by integrelly molding technique using the cover material of the invention. Moreover, the cover material of the invention is well suited to make thin products such as sun visors as is easily understood from a thin and elongate product and its test results already shown and explained in Figure 4 and Figure 5.

Claims

1. A cover material for an integrally foamed article, comprising a permeable fabric and a thin layer of latex foam bonded to the back surface of said fabric,

characterized in that said thin layer of latex foam is bonded at its one surface to said back surface, and said latex foam has numerous mechanical open cells which are formed in an internal part thereof and communicating with each other from end to end, and a very thin skin formed in an opposite surface to said one surface of said layer, said skin having numerous minute holes communicating with some of said mechanical open cells and being far smaller in size than said mechanical open cells, yet said skin presenting a substantially flat and smooth barrier surface which serves to guide slidingly a foamable mixture to be injected onto said barrier surface as a body foam of said article.

2. A cover material as claimed in Claim 1 wherein said latex foam are securedly bonded to said fabric such as it embraces and adheres to individual fibers composing said fabric to form mechanical bondings therebetween.

3. A cover material as claimed in Claim 1 wherein said open cells formed in said latex foam layer exist with a density in the range of from 20,000 cells per cm^2 to 70,000 cells per cm^2.

4. A cover material as claimed in Claim 1 wherein said open cells in the region adjacent to said skin have a size of from about 2μ to 10μ, and said open cells in the inward part therefrom have a size of from about 10μ to 30μ.

5. A cover material as claimed in Claim 1 wherein said fabric is selected from the group consisting of knitted, woven and non-woven fabrics made of natural fibers such as cotton and wool, various sythetic fibers and mixtures thereof, said fabric having a good permeability.

6. A cover material as claimed in Claim 1 wherein said latex foam layer is formed from high molecular latex material selected from the group consisting of rubber latices including natural rubbers, synthetic rubbers and various modified forms and copolymers thereof such as styrene butadiene rubber, acrylonitrile butadiene rubber, natural rubber, silicone rubber and methylene butadiene rubber; and resinous latices including various natural and synthetic resins and various modified forms and alloy and copolymers thereof such as acrylic, urethane, vinyl chloride, vinyl acetate, polyvinyl alcohol, polystyrene and polyethylene.

7. A cover material as claimed in Claim 6 wherein said latex is an acrylic copolymer.

8. A cover material as claimed in Claim 6 wherein said latex foam layer has a thickness in the range of from 0.1 to 3.0 mm.

9. A cover material as claimed in Claim 1 wherein said fabric is a knitted polyester fabric, said latex foam layer is of urethane and said open cells exist in the number of 30,000 - 60,000 cells per cm^2.

10. A method for manufacturing a cover material having latex foam backing, comprising the steps of:
a) providing a permeable fabric selected from the group consisting of knitted, woven and non-woven fabrics made of natural fibers such as cotton and wool, various synthetic fibers, and mixtures thereof,
b) applying to one surface of said selected fabric a high molecular latex material, subsequently to thorough stirring of said latex, as a back-coating at a temperature in the range of 20 - 40 °C with a uniform thickness such that said latex material, upon completing its foaming and curing, can attain the thickness of from about 0.1 -3.0 mm, said latex material being selected from the group consisting of rubber latices including natural rubber, synthetic rubber and various modified forms and copolymers thereof such as styrene butadiene rubber, acrylonitrile butadiene rubber, natural rubber, silicone rubber and methylene butadiene rubber; and resinous latices including various natural and synthetic resins and various modified forms and alloy and copolymers thereof such as acrylic, urethane, vinyl chloride, vinyl acetate, polyvinyl alcohol, polystyrene and polyethylene, and
c) drying preliminarily said latex back-coating at a temperature in the range of from 80 to 120 °C for the period of 3 - 5 minutes, and permitting said back-coating to cure at a temperature of 150 °C for 2 - 3 minutes thereby to cause a very thin permeable skin to form on the surface of said back-coating and also a mechanical open cells to form in the internal part of said back-coating, whereby a cover material having a thin layer of latex foam bonded mechanically to said one surface is manufactured.

11. A method as claimed in Claim 10 wherein said latex material is applied by means of knife-coating technique.

12. A method as claimed in Claim 10 wherein said latex material is applied by means of roll-coating technique.

13. A method as claimed in Claim 10 wherein said stirring step is carried out for the period of 3 - 15 minutes while holding said latex material at a temperature in the range of 20 - 40 °C in order to cause a latex foam having a low to said fabric.

14. A method as claimed in Claim 10 wherein, after said preliminary drying and subsquent to said curing, said fabric applied with said latex layer is subjected to a crushing step thereby to adjustably increase the permeability of the latex foam layer.

15. An integrally foamed article composed of a cover material with a fabric (10) and a thin layer of latex foam (15) applied directly to the back surface of said fabric, and of a body foam (25) formed from a liquid material poured directly on said latex foam and foamed and cured thereat,

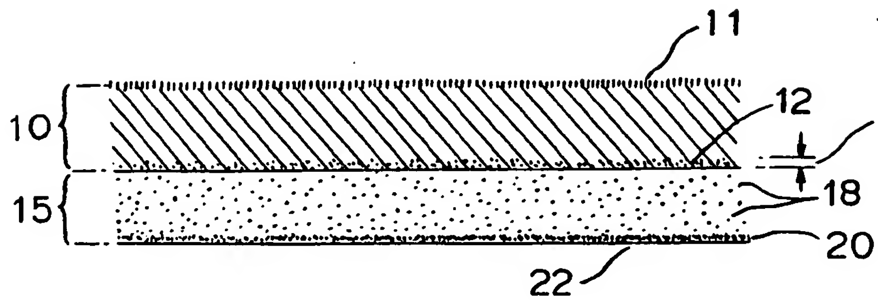
characterized in that said thin layer of latex foam has bonding zone (17) adjacent to said fabric back surface such that portions of said foam embrace some of individual fibers of said fabric, numerous mechanical open cells (18) formed in the internal part of said latex foam to ensure good permeability, and a layer of denser or minor cells (20) and a very thin permeable skin (22) outward from said internal part, said skin being formed with innumerable minute holes (21) and yet presenting a substantially flat and smooth surface against a foamable liquid mixuture for said body foam (25) whereby said skin is capable of substantially preventing impregnation or penetration of said mixture and yet making strong mechanical bonding with said body foam (25).

16. An integrally foamed article as claimed in Claim 15 wherein said fabric is knitted polyester fabric; said latex is urethane latex, and the number of open cells is from 30,000 to 60,000 cells per cm^2, and said body foam is polyurethane.

17. An integrally foamed article as claimed in Claim 15 wherein said articles are seat components.

18. A sun visor copmrising a cover material having a thin layer of latex foam applied to its inner surface and being shaped into a thin hollow shape, and a body foam made by pouring liquid stock material into said hollow shape and permitting said stock material to foam and cure thereat.

Fig. 1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22

Fig. 2

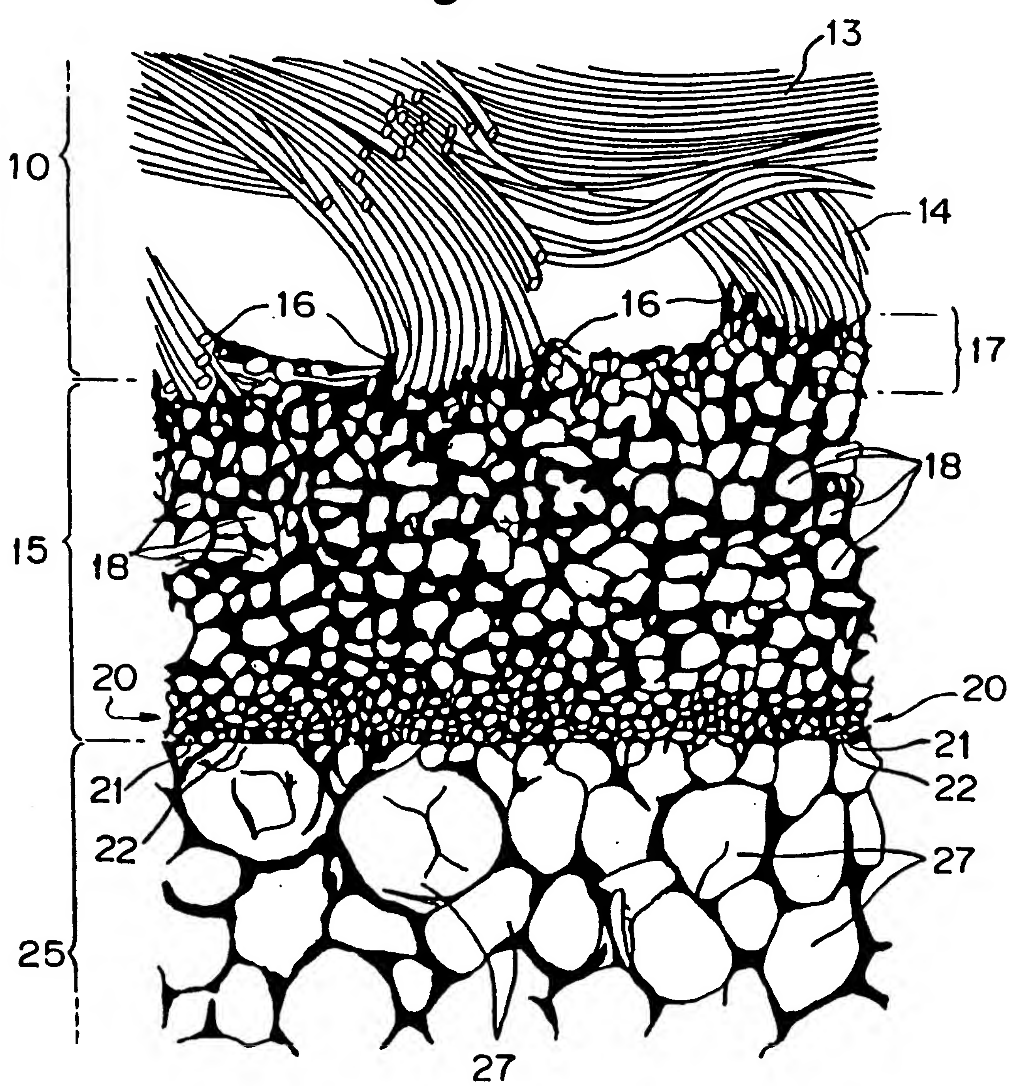
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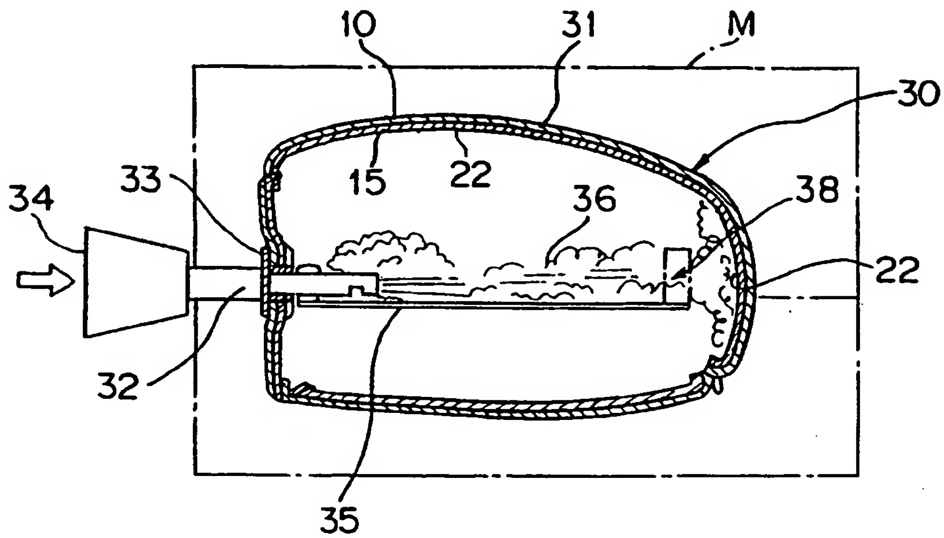
Fig. 3


10
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M
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32
35

Fig. 4

(A)

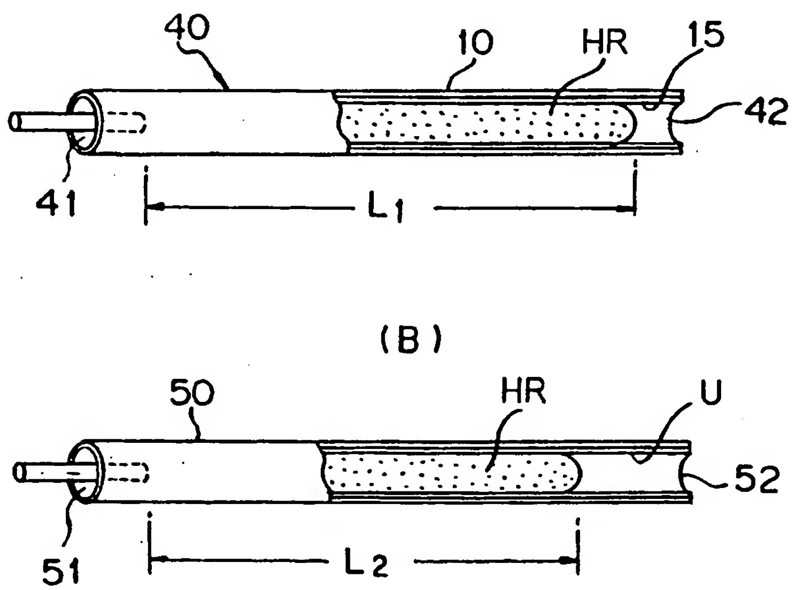

40
10
HR
15
42
41
L1
(B)
50
HR
U
52
51
L2

Fig. 5

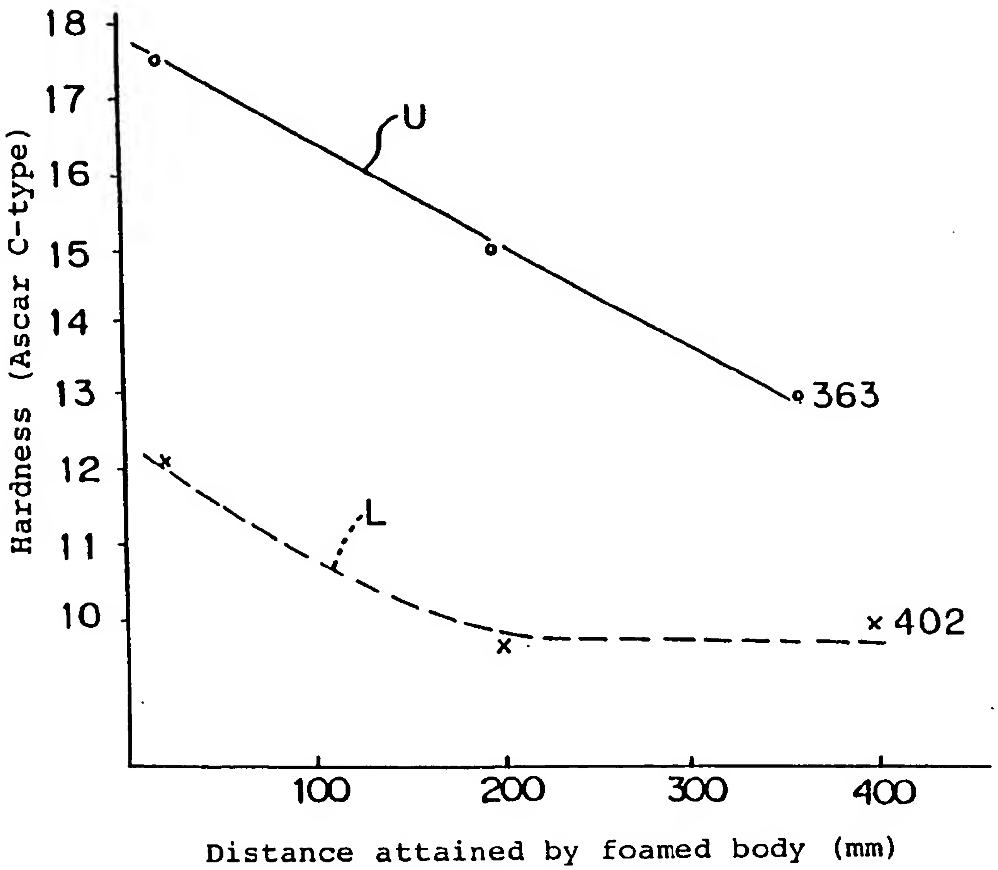

18
17
16
15
14
13
12
11
10
Hardness (Ascar C-type)
U
363
L
402
100
200
300
400
Distance attained by foamed body (mm)

Fig. 6

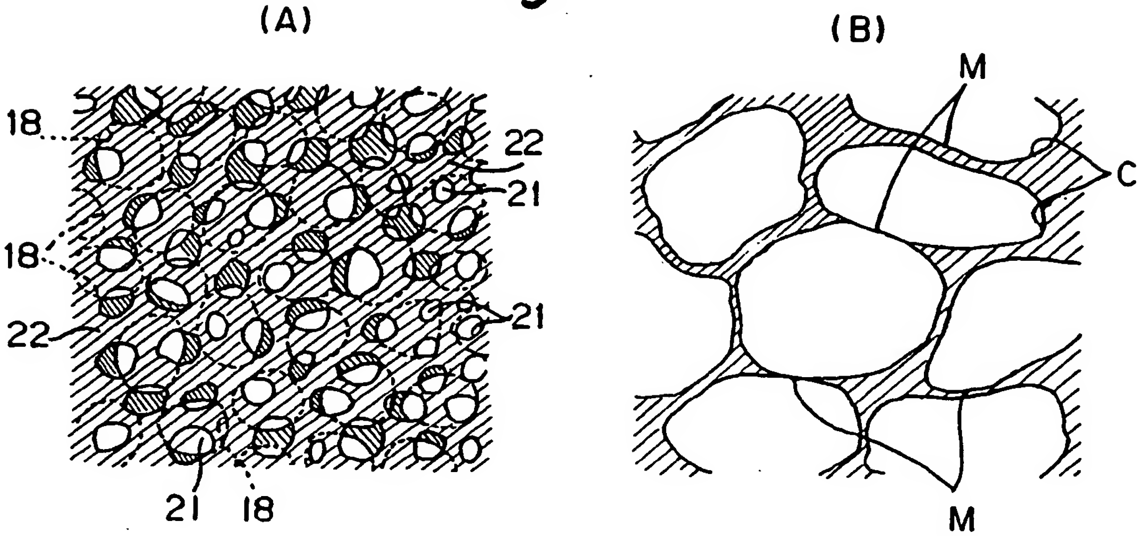
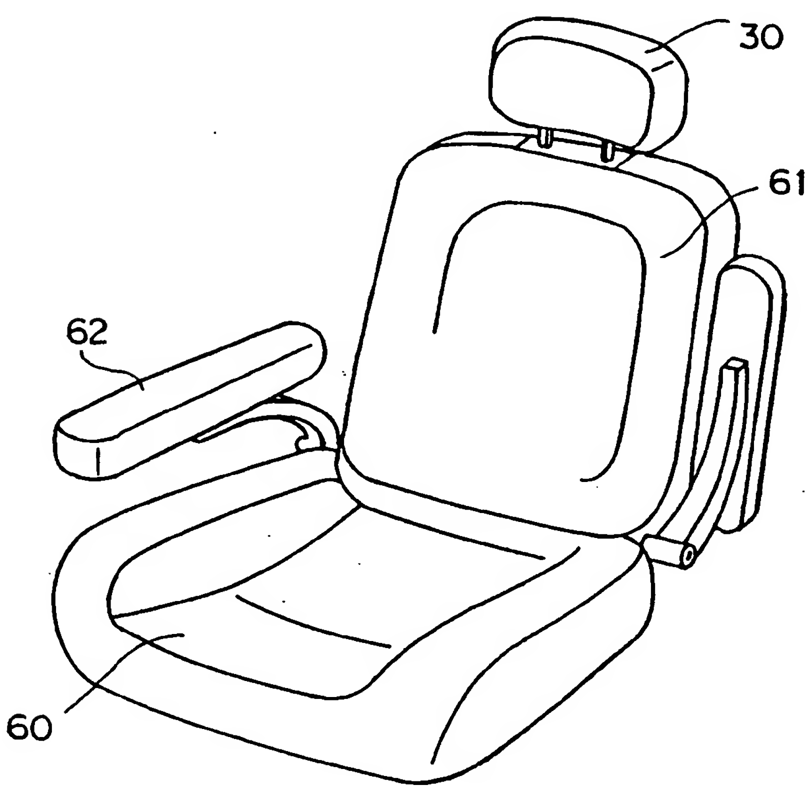


Fig. 7



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP91/01135

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl^5 B29C39/10, B68G7/00//B29K105:04, B29L31:58

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B29C39/10

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1926 - 1991
Kokai Jitsuyo Shinan Koho	1971 - 1991

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 60-127116 (Tokyo Sheet K.K.), July 6, 1985 (06. 07. 85), Claim, (Family: none)	1-18
A	JP, A, 2-125724 (Shigeru Kogyo K.K., Honshu Paper Co., Ltd.), May 14, 1990 (14. 05. 90), Claims 1, 6, (Family: none)	1-18

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
October 21, 1991 (21. 10. 91)	November 11, 1991 (11. 11. 91)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	